(12) UK Patent Application (19) GB (11) 2 110 472 A

(21) Application No 8230361
(22) Date of filing 25 Oct 1982
(30) Priority data
(31) 56/157946
(32) 23 Oct 1981
(33) Japan (JP)
(43) Application published
15 Jun 1983
(51) INT CL³
H01H 15/18
(52) Domestic classification
H1N 541 597 61X 631 639 649 662 700 701 729 GN
(56) Documents cited
GB 1435492
GB 0578347
GB 0265645
(58) Field of search
H1N
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(54) Electric switch

(57) A switch comprises a drive element 6 inserted in a through hole 1d of an operating member 1 and placed so as to execute a rocking motion on a frame 3. When the operating component 1 is operated, the drive element 6 is caused to slide on a movable contact plate 14 to swing the moving contacts, such that the contacts are switched. The distance A between the edges of the lower opening of said through hole 1d with which said drive element 6 comes into contact, in the direction in which said drive element slides, is selected to be greater by a predetermined amount S than the width of said drive element B, so that when said drive element is brought into contact with one edge of said opening, a gap of a predetermined distance is formed between the drive element and the other edge of said opening. Contact chatter is thereby avoided since a rapid snap-over is achieved.

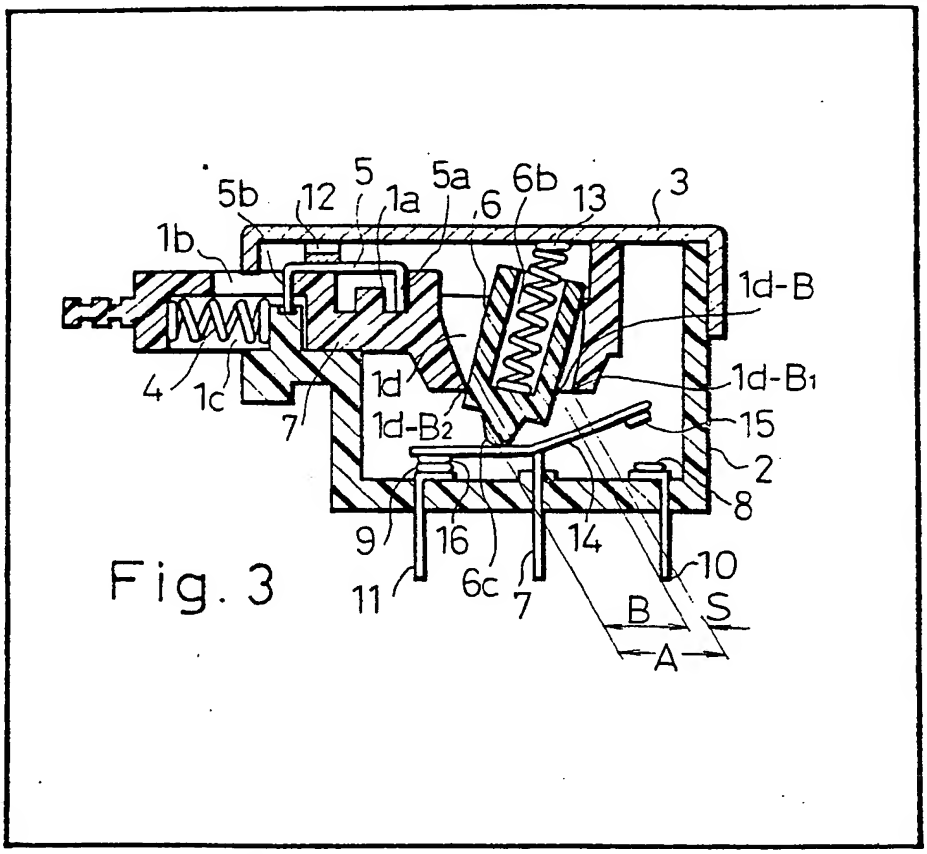

Fig. 3

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The drawings originally filed were informal and the print here reproduced is taken from a later filed formal copy.

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Fig.1
PRIOR ART

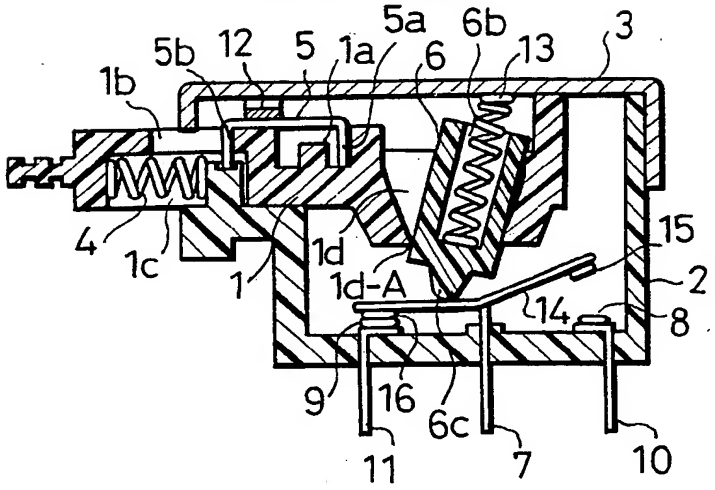
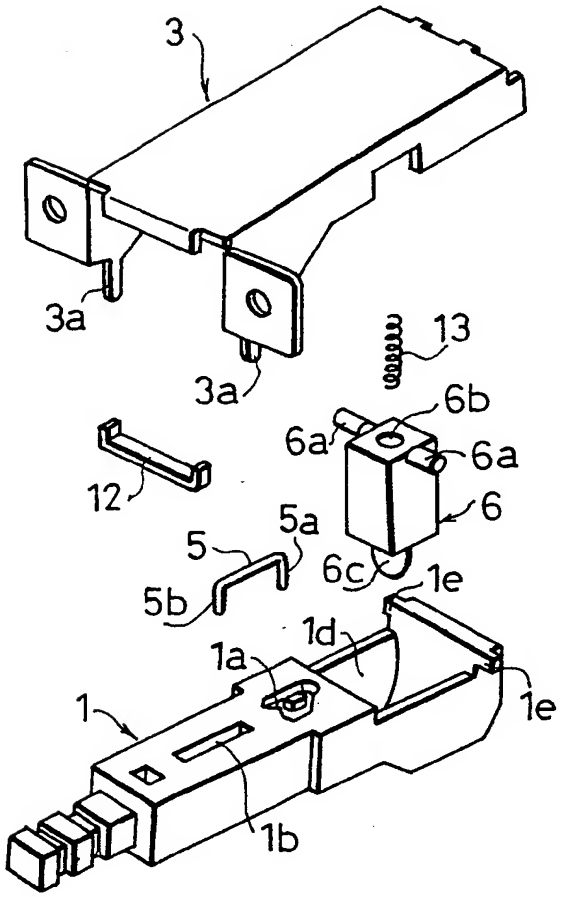


Fig.2
PRIOR ART



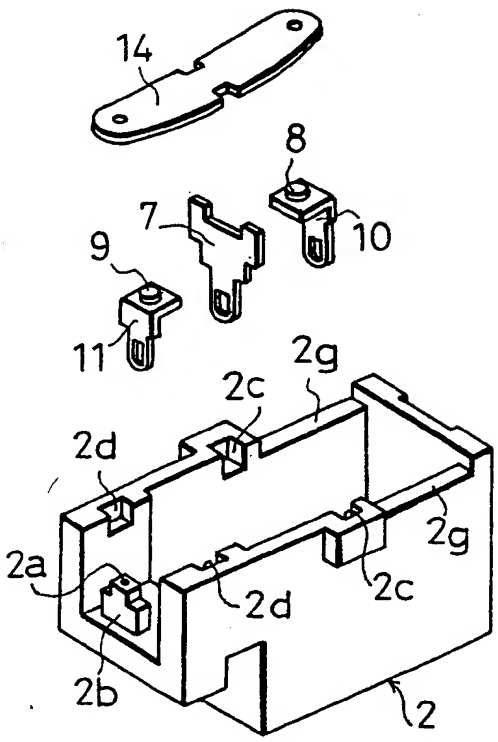


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Fig. 3

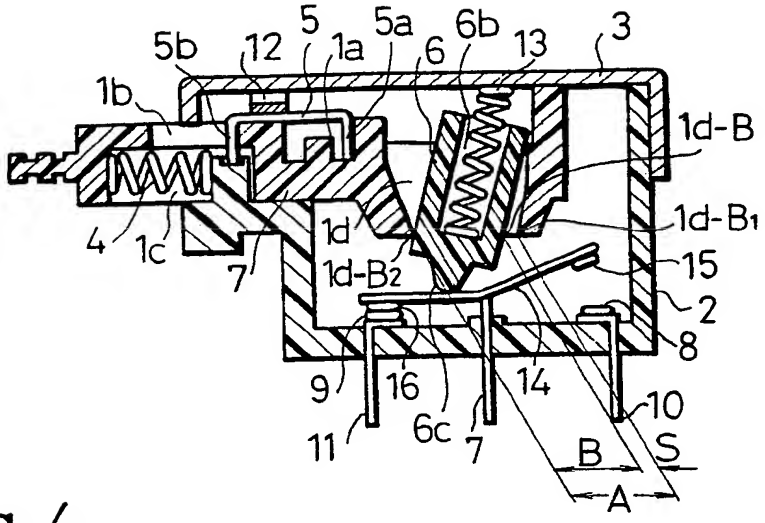


Fig. 4

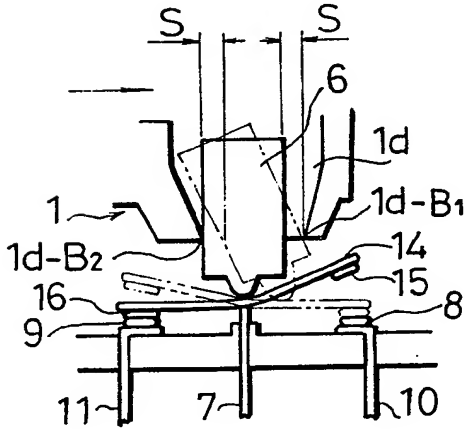
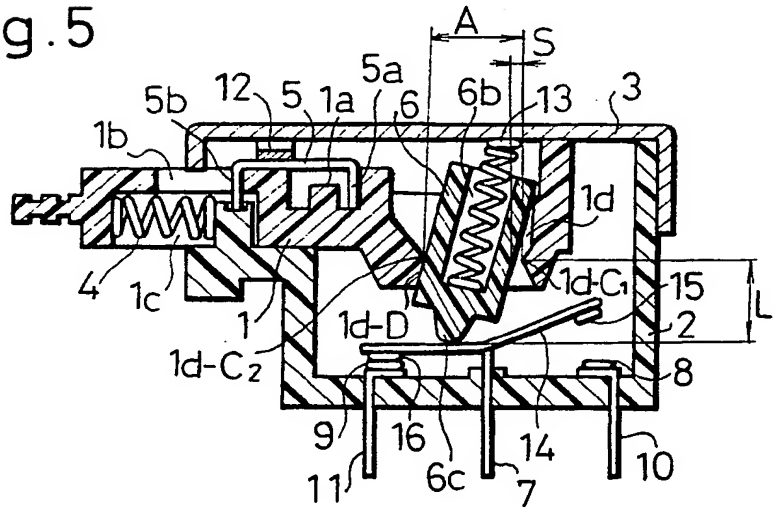


Fig. 5



SPECIFICATION
Switch

Background of the invention

Field of the invention

The present invention relates to a switch having a seewaw contact construction, in which a drive element urged by a compression spring is inserted in a through hole in a slidable operation member, so that the drive element slides on a movable contact plate accompanying the movement of the operation member to change the contact points.

Prior art

For the purpose of comparison with the present invention, construction of a conventional switch of this type will be described below with reference to Figures 1 and 2.

In Figures 1 and 2, reference numeral 1 denotes an operation member made of a synthetic resin, and which is which slides within a frame 2 and a cover plate 3 that will be described later. In the operating component 1 are a heart-shaped cam groove 1a in which one end 5a of a drive pin 5 is inserted as will be described later, a slide hole 1b in which other end 5b of the drive pin 5 will be inserted, a recessed portion 1c for accommodating a return coil spring 4, and a conical hole through 1d which is widest at the top. The hole through 1d has a square shaped cross-section, the opening 1d-A at the lower end being the same size as the width of a drive element 6 that will be described later. The drive element 6 inserted in the through hole 1d is prevented by the opening 1d-A from moving right and left in Figure 1.

The frame 2 is made of a synthetic resin, and in the bottom thereof are studded a support terminal 7, and fixed terminals 10, 11 with rigidly attached fixed contacts 8, 9. The frame 2 has a protrusion 2b with a hole 2a in which one end 5b of the drive pin 5 will be inserted, cut-away portions 2c in which arms 6a of a drive element 6 will be inserted, and cut-away portions 2d with which will engage a holder plate 12 that holds the drive pin 5. The cover plate 3 is obtained by punching a metal plate, and is folded, and has pawls 3a at the front lower side thereof.

The drive pin 5 is formed by bending a wire approximately into a U-shape. One end of the drive pin is in the heart-shaped cam groove 1a, and the other end is inserted in the hole 2a of the frame 2. The drive element 6 is almost cubic in shape, and has arms 6a protruded in the lateral directions at the upper end thereof, and a semispherical protuberance 6c protruding from the lower surface thereof. A hole 6b is also formed in the upper surface to accommodate a compression spring 13. Reference numeral 14 denotes a movable contact plate which is bent at a suitable angle with its center as a boundary. The movable contact plate 14 has moving contact points 15, 16 attached to both ends thereof, and is supported at its central portion by the support terminal 7. Further, the movable contact plate 14 is always pressed toward the bottom of the frame 2 by the protuberance 6c of the drive element 6. As the drive element 6 slides on the movable contact plate 14, the switch is so operated that the fixed contact 9 and the moving contact 16 are connected together, or the fixed contact 8 and the moving contact 15 are connected together.

The switch is assembled as follows. First, the movable contact plate 14 is mounted so that it executes a rocking motion on the supporting post 7 in the frame 2. Then, the protrusion of the frame 2 is inserted in the recessed portion 1c of the operating member 1 with its operating side protruding beyond the frame 2, and the protrusions 1e are placed on flat recessed portions 2g of the frame 2; the operating component 1 is thus placed on the frame 2. The drive element 6 is then inserted in the through hole 1d of the operating component 1 to bring the protuberance 6c into contact with the movable contact plate 14, while inserting the arms 6a in the cut-away portions 2c of the frame 2, and accommodating the coil spring 13 in the hole 6b. The drive pin 5 is then inserted in the heart-shaped cam groove 1a and in the hole 2a of the protrusion through slide hole 1b. Thereafter, the holder plate 12 is placed on the drive pin 5 at right angles thereto, and both ends of the holder plate 12 are placed on the cut-away portions 2d of the frame 2. Finally, the cover plate 3 is placed on the frame 2, the pawls 3a are tightened to mount the cover plate 3 on the frame 2, and a return coil spring 4 is accommodated in the recessed portion 1c in the operation member 1, to complete the assembling operation. With the cover plate 3 being mounted on the frame 2, the compression spring 13 partly accommodated in the drive element 6 is compressed, thereby causing the protuberance to press against the movable contact plate 14 continuously.

Below is described the switching operation of the switch thus constructed. The operating component 1 under the condition of Figure 1 is depressed against the force of the return coil spring 4. As the operating component 1 moves, the drive element 6 swings on the axis of the arms 6a, since the drive element 6 is in contact with the edge of the opening 1d-A on the lower side of the through hole 1d of the operating component 1. As the drive element 6 swings, the protuberance 6c slides on the movable contact plate 14 while pressing it. When the protuberance 6c reaches the support terminal 7, the spring 13 is compressed to its maximum. At this point, the slightest movement of the operating component 1 will rock the plate 14 off the post 7, releasing the compressed spring 13 so that contact 16 breaks contact with contact 9 and contact 15 makes contact with contact 8, in a fast rocking motion. At the same time, the operating component 1 is locked in position owing to the function of the drive pin 5 and the heart-shaped cam groove 1a. When the operating component 1 is depressed again, the drive pin 5 is unlocked.

That is, owing to the function of the return coil spring 4, the operating component 1 and the drive element 6 return to the initial state through the above-mentioned steps in the opposite order, whereby the moving contact 15 breaks away from the fixed contact 8, and the moving contact 16 comes into contact with the fixed contact 9 to switch the circuit. In the switch thus constructed, the operating component 1 is not adversely affected by the switching operation, the switch responds to a light touch, has a crisp, positive feel, and since the mechanism can be operated from one direction only, it is suitable for automatic operation.

However, the movable contact plate 14 is rocked by the drive element 6 which moves at the same speed as the operating component 1. Therefore, the moving (sliding) speed of the operating component 1 is equal to the moving (sliding) speed of the drive component 6, and the opening and closing speed of the moving contacts 15, 16 relative to the fixed contacts 8, 9 varies with the pressure exerted by operating component 1. Furthermore, at a position at which the protuberance 6c of the drive element 6 reaches the support terminal, the direction in which the compression spring 13 exerts the driving force is at right angles to the bottom of the frame 2, and the center of the movable contact plate 14 serves as a point of action, i.e., serves as a dead point when switching contact points. Therefore, the make/break state of the contacts is very unstable when the drive element is near the center of the plate. When the operation member 1 is pushed slowly, the instability just described causes chattering or contacts being welded together by arcing. These conditions reduce the reliability of the switch and shorten its working life.

Summary of the invention

The present invention is designed to eliminate the above-mentioned defects, and its object is to provide a switch which prevents the contacts from becoming defective through chattering, and which makes it possible to switch contacts with increased stability and reliability.

An embodiment of the invention will be described below in conjunction with the accompanying drawings.

Brief description of the drawings

Figures 1 and 2 illustrate a conventional example, in which:

Figure 1 is a sectional side view of a switch;

Figure 2 is a perspective view of a disassembled switch;

Figures 3 and 4 illustrate an embodiment of the present invention, in which:

Figure 3 is a sectional side view of a switch;

Figure 4 is a diagram illustrating the operation of the switch; and

Figure 5 is a sectional side view of the switch showing another embodiment of the present invention.

Description of the preferred embodiments

Figure 3 is a sectional side view of the switch, and Figure 4 is a diagram illustrating the operation. In the drawings, the same portions as those of the conventional switch are denoted by the same reference numerals and their description is omitted. According to this embodiment, the distance between the edge 1d-B_1 and the edge 1d-B_2 in the opening 1d-B on the lower side of the through hole 1d of the operation member 1, i.e., the width A in the sliding direction of the drive element 6, has been designed to be greater than the width B of the drive element 6. Therefore, the drive element 6 inserted in the opening 1d-B presses the movable contact plate 14 maintaining a gap S relative to the edge 1d-B_1 of the opening 1d-B as shown in Figure 3.

Mentioned below is the operation of the switch, thus constructed. Before the operating component 1 is pressed, the line of action of the coil spring 13 is on the side of the fixed terminal 11 as shown in Figure 3. Therefore, the protuberance of the drive element drives the movable contact plate 14 toward the side of the moving contact 16, so that the moving contact 16 comes into contact with the fixed contact 9. Further, the center of the through hole 1d is located at a middle position between the fixed terminal 11 and the support terminal 7, and the drive element 6 comes into contact with the edge 1d-B_2 of the opening 1d-B to form a gap S relative to the edge 1d-B_1. In this condition, if the operating component 1 is pressed against the force of the return coil spring 4, the drive element 6 is pushed by the front edge 1d-B_2; i.e., the drive element 6 slides and rotates on the axis of the arms 6A. The protuberance 6c of the drive element 6 then slides on the movable contact plate 14 to reach the support terminal 7 where the compression spring 13 is compressed to its maximum degree. As the operating component 1 is further pressed, the line of action of the compression spring 13 changes toward the side of the fixed terminal 8, and the movable contact plate 14 rocks abruptly. When the direction of action line changes, the drive element 6 automatically slides on the movable contact plate 14 without relying upon the pressing operation of the operation member 1, owing to the presence of gap S relative to the edge 1d-B_1. That is, the drive element 6 slides by itself over a distance equal to the gap S (shifts from the stage of the solid line to the state of broken line in Figure 4). Furthermore, the state in which the protuberance 6c is directly over the support terminal 7 is passed over quickly. This is to say the unstable state no force is exerted to press the moving contact onto the fixed contact, is passed without developing chattering because the drive element instantaneously slides over the distance of the gap S driven by the force of inertia produced by the movement of the operating component (drive element 6). Therefore, the unstable state is passed instantaneously as a result of the sliding the turning operation of the drive element 6 without

regard to the pushing operation of the operating component 1. Accordingly, the moving contact 15 comes into contact with the fixed contact 8 to switch the circuit. The thus switched state is then locked by the drive pin 5 as mentioned earlier. To return the contacts to the initial state, the operating component 1 should be pressed again. Through the steps in the reverse order, therefore, the unstable state is passed instantaneously, and the contacts are switched. The relation between the width A of the opening 1d-B and the width B of the drive element 6 is such that a gap S formed between them makes it possible to obtain an angle of action line of the compression spring 13 which is sufficient to drive the movable contact plate 14 as the protuberance 6c slides down from above the support terminal 7. Provision of the gap S offers other advantages. That is, when the protuberance 6c of the drive element 6 approaches the support terminal 7, i.e., even when movement of the operating component 1 is temporarily stopped at that position, the drive element turns and slides by itself owing to the force of inertia. Furthermore, the contact points are switched even when the moving distance of the operating element 1 is small. That is to say, the distance which the operating element 1 travels may be reduced by an amount corresponding to the gap S.

Another embodiment of the present invention will be described below in conjunction with Figure 5 which is a sectional side view of the switch. According to this embodiment, edges 1d-C_1 and 1d-C_2 are formed in the middle portion of the hole 1d so that the drive element 6 will come into contact therewith, and a titled surface 1d-D is formed on the lower side of the hole 1d with which the side surface of the drive element 6 will come into contact to stop its rotating and sliding motion. The width between the edges 1d-C_1 and 1d-C_2 is equal to the width A between the edges 1d-B_1 and 1d-B_2 of the opening 1d-B in the above-mentioned embodiment. With the drive element 6 being inserted in the thus constructed hole 1d, the distance L is lengthened from the edges 1d-C_1, 1d-C_2 to the protuberance 6c of the drive element 6. Therefore, the turning range can be reduced without changing the sliding distance of the drive element 6, the contacts can be reliably switched, and the operating component 1 needs be moved over only a small distance.

According to the switch of the present invention, as described above, the lower opening of the through hole in which the drive element is inserted is widened toward the directions in which the drive element will slide and turn, and a predetermined gap is maintained between the drive element and the edge of the opening. Therefore, the drive element turns and slides by itself over a distance equal to the gap irrespective of the moving distance of the operating component, and the unstable state of the contacts is passed through instantaneously. Consequently, the contact points can be switched instantaneously, reliably and stably, presenting such practical advantages as longer contact life, and the operating element movement being reduced by an amount equal to the distance of the gap.

Claims

1. A push-button switch comprising:

(a) a switch housing;

(b) a support terminal and fixed contacts disposed being separated from the support terminal, said support terminal and said fixed contacts being studded on the bottom of said switch housing;

(c) a movable contact plate having contacts that correspond to said fixed contacts;

(d) a slider which slides in said switch housing from the external side thereof via a coil spring, said slider having a hole through its long axis;

(e) a drive element which is always driven by a compression spring onto the upper surface of said movable contact plate;

(f) the hole through said slider having a size which is greater than the width of the drive element by a predetermined amount; and

(g) said movable contact plate being caused to rock by the tip of said drive element responsive to the sliding motion of said slider.

2. A push-button switch according to claim 1, wherein when the drive element is brought into contact with either one edge of the opening on the lower side of the through hole formed in the slider, a gap of a predetermined distance is formed between the drive element and the other edge of the opening on the lower side of the through hole.

3. A push-button switch according to claim 1, wherein the through hole formed in the slider has a conical shape which spreads upwards.

4. A push-button switch according to claim 1, wherein the drive element has nearly a square shape, has a semi-circular protuberance that protrudes from the lower surface thereof, and has a hole in the upper surface thereof to accommodate a compression spring.

5. A push-button switch according to claim 1, wherein fixed contacts are disposed on both sides of the support terminal, and moving contacts are attached to the movable contact plate so as to correspond to said fixed contacts.

6. A switch having a contact member which can be rocked about a pivot axis to make and break switch contacts, an engaging member biased into engagement with the contact member, and an operating member having engaging surfaces for engaging opposite sides of the engaging member in order to shift the engaging member in such a way that the point of contact of the engaging member with the contact member shifts across the pivot axis to produce rocking movement of the contact member, wherein the distance between said engaging surfaces is greater by a predetermined amount than the width of the engaging member, so that, as the point of contact of the engaging member with the contact member reaches said pivot axis,

the engaging surfaces are incapable of holding the engaging member in equilibrium and the point of contact shifts to one or the other side of the pivot axis.

7. A switch substantially as herein described with reference to Figures 3 and 4 or Figure 5 of the accompanying drawings.

New claims or amendments to claims filed on 14 January 1983.

Superseded claims 1 to 5.

New or amended claims:—

1. A push-button switch comprising:

(a) a switch housing;

(b) a support and fixed contacts held on the bottom of said switch housing with the fixed contacts spaced from the support;

(c) a movable contact plate pivotally supported by said support and having contacts that correspond to said fixed contacts;

(d) a slider adapted to slide within said switch housing, said slider having a hole therethrough;

(e) a drive element held within said hole and urged by a compression spring onto the upper surface of said movable contact plate;

(f) the hole through said slider having a size which is greater than the width of the drive element by a predetermined amount; and

(g) said movable contact plate being caused to rock by the tip of said drive element in response to the sliding motion of said slider.

2. A push button switch according to claim 1, wherein when the drive element is brought into contact with either one edge of the opening on the lower side of the hole formed in the slider, a gap of a predetermined distance is formed between the drive element and the other edge of the opening on the lower side of the hole.

3. A push-button switch according to claim 1, wherein the hole formed in the slider has a conical shape flaring upwardly.

4. A push-button switch according to claim 1, wherein the drive element has nearly a square section, has a semicircular protuberance that protrudes from the lower surface thereof, and has a hole in the upper surface thereof to accommodate a compression spring.

5. A push-button switch according to claim 1, wherein fixed contacts are disposed on respective sides of the support terminal, and moving contacts are attached to the movable contact plate so as to correspond to said fixed contacts.

Printed for Her Majesty's Stationery Office by the Courier Press, Leamington Spa, 1983. Published by the Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained